Center for Space Nuclear Research Director Steve Howe, left, talks with interns Sebastien Frand and Rob O'Brien, two students capitalizing on collaborations between CSNR and universities abroad.

International students find their place at the Center for Space Nuclear Research

by Jo Seely, *INL Nuclear Science & Technology communications intern*

Idaho National Laboratory's Center for Space Nuclear Research (CSNR) Fellowship Program has been a place for engineering students to apply their nuclear energy interests to space research since 2006. Now more than ever, students are taking advantage of space nuclear research opportunities at INL due to collaborations between CSNR and universities abroad.

"My experience working with CSNR has been very positive," said Rob O'Brien of the University of Leicester in England. "It's enabled me to do a lot of things that I couldn't have done in the facilities back in the U.K. or in Europe."

Howe, Frand and O'Brien at the Spark Sintering (SPS) at INL.

O'Brien, along with Sebastien Frand of the National Institute for Nuclear Science and Technology (INSTN) in France, worked on CSNR missions this summer. The two have added their own perspectives in their different areas of expertise.

"Both individuals have brought enthusiasm, a level of energy and a strong determination to working in space exploration," said Steve Howe, CSNR director.

O'Brien first heard of the fellowship program from his academic advisers when CSNR was established in 2006 under the direction of INL and the Universities Space Research Association (USRA). To continue his work in propulsion technologies, O'Brien came to INL as a CSNR fellow in 2006 and has returned each summer since. O'Brien began studying the encapsulation of radioisotopes and nuclear fuels within tungsten using the resources surrounding him at INL, including the Spark Plasma Sintering furnace at INL's Center for Advanced Energy Studies. The furnace is one of only a handful of such devices in the world.

"It's pretty unique to be able to use the equipment, such as the furnace, and to be surrounded with the expertise and the support," said O'Brien. "Not just to have the machine, but then to have the nuclear expertise as well. That's really important."

Frand attends the National Institute for Nuclear Science and Technology in France and O'Brien is from the University of Leicester in England.

This summer, O'Brien became a student within the Next Degree program, which gives students the opportunity to finish their degrees while continuing to conduct research at INL. The program allowed O'Brien to complete his Ph.D. through Leicester while continuing his INL work with tungsten fabrication.

"There's a lot to be said for tungsten encapsulation," said O'Brien. "I'd love to continue the work I've done for my Ph.D. thesis through my early career. It's an exciting project, and working in the space nuclear sector is an exciting field to be in."

Frand came to CSNR in order to fulfill his degree and gained a great deal of knowledge in modeling. Because France's INSTN program requires an internship in another country, Frand spent his summer modeling a nuclear thermal reactor (NTR) as well as working on numerical methods to solve the transport equation.

"I was able to work in different areas of modeling and research, allowing me to find my own area of interest," said Frand. "Through the different projects, I met many people leading to other opportunities."

CSNR Director Howe said Frand has made remarkable progress on modeling a nuclear thermal rocket while O'Brien is becoming an expert in tungsten fabrication. "They are essentially leading our efforts in those areas," he said.

Both Frand and O'Brien contacted Howe with interest in the fellowship program even with no guarantee of funding. Their initial interest is now creating future opportunities for other students as discussions have started with O'Brien's and Frand's home universities, says Howe.

"We're currently trying to expand the program," said Howe. "We are continuing to build both the CSNR Summer Fellowship and the Next Degree program."

Both O'Brien and Frand said they would encourage other students to work at CSNR and INL.

"It's been an excellent learning experience," said O'Brien. "Working with people in the field has been excellent because everyone that I have come into contact with in the national lab has encouraged me to pursue this and continue this work."

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O'Brien and Frand said they would encourage others to do summer internships at INL.